WHAT IS CLAIMED IS:

1. A semiconductor device, comprising:

a semiconductor substrate having a first surface and a second surface opposite the first surface, and having a piercing hole piercing there-through from the first surface to the second surface;

an insulating film formed on the first surface of the semiconductor substrate having the piercing hole extended there-through; and

a piercing electrode formed in the piercing hole and extending from the insulating film to the second surface,

wherein the piercing hole has a first diameter in the insulating film and a second diameter in the semiconductor substrate which is wider than the first diameter;

the piercing electrode has a substantially same diameter as the first diameter along a whole length thereof; and

an insulating film sleeve lies between the piercing electrode and an inside wall of the piercing hole in the semiconductor substrate.

2. The semiconductor device as claimed in claim 1, wherein the insulating film sleeve is made of an organosiloxane group material, a siloxane hydroxide group material, an organic polymer, or a porus material of the organosiloxane group material, the siloxane hydroxide group material, or the

organic polymer.

3. The semiconductor device as claimed in claim 1, wherein the insulating film sleeve has a relative permeability of approximately 3.0 and under.

4. The semiconductor device as claimed in claim 1, wherein the piercing electrode is made of a metal whose main component is a copper.

5. A semiconductor integrated circuit device, comprising:

a support substrate; and

a plurality of semiconductor chips stacked on the support substrate;

the semiconductor chip including a semiconductor substrate; a semiconductor element formed on a first surface of the semiconductor chip; an insulating film formed on the first surface of the semiconductor chip as covering the semiconductor element; a multi-layer interconnection structure formed on the insulating film; a piercing hole formed in the semiconductor chip as piercing from the first surface into the insulating film through a second surface facing to the first surface; and a piercing electrode formed in the piercing hole and extending from the first surface to the second surface; wherein the piercing hole has a first

diameter in the insulating film and a second diameter in the semiconductor chip which is bigger than the first diameter; the piercing electrode has a substantially same diameter as the first diameter along whole length; and an insulating film sleeve lies between the piercing electrode and an inside wall of the piercing hole in the semiconductor substrate.

6. The semiconductor integrated circuit device as claimed in claim 5, wherein the insulating film sleeve is made of an organosiloxane group material, a siloxane hydroxide group material, an organic polymer, or a porus material of the organosiloxane group material, the siloxane hydroxide group material, or the organic polymer.

7. The semiconductor integrated circuit device as claimed in claim 5, wherein the insulating film sleeve has a relative permeability of approximately 3.0 and under.

8. The semiconductor integrated circuit device as claimed in claim 5, wherein the piercing electrode is made of a metal whose main component is a copper.

9. A method of manufacturing a semiconductor device having a piercing electrode, comprising:

a step of forming an insulating film on a first main surface of a semiconductor substrate;

a step of forming an opening which exposes the semiconductor substrate and has a first diameter, in the insulating film;

a step of forming a concave which has a second diameter wider than the first diameter in the semiconductor substrate and extends from the opening into the semiconductor substrate, by anisotropic etching which acts in a direction substantially perpendicular to the main surface of the semiconductor substrate and which utilizes the insulating film as a mask;

a step of filling the opening and the concave with an application insulating film;

a step of forming a space that continuously extends from the opening to a depth into the application insulating film filling the concave, by anisotropic etching which etches the application insulating film on a direction substantially perpendicular to the main surface of the semiconductor substrate and which utilizes the insulating film as a mask;

a step of stacking a conductive layer on the insulating film as filling the opening and the space;

a step of forming a conductive plug in the opening and the space by removing the conductive layer from the insulating film; and

a step of exposing the conductive plug by a process of removing what covers the conductive plug and what stacks on a second main surface of the semiconductor substrate which is opposite to the first main surface from the second main surface.

10. The method of manufacturing a semiconductor device as claimed in claim 9 wherein the application insulating film is made of an organosiloxane group material, a siloxane hydroxide group material, an organic polymer, or a porus material of the organosiloxane group material, the siloxane hydroxide group material, or the organic polymer.

11. The method of manufacturing a semiconductor device as claimed in claim 9 wherein the application insulating film has a relative permeability of approximately 3.0 and under.

12. The method of manufacturing a semiconductor device as claimed in claim 9 wherein the process of removing the construction material regarding the semiconductor substrate from the second main surface of the semiconductor substrate comprises a dry etching process, and the application insulating film is made of a material which is tolerant to the dry etching process.

13. The method of manufacturing a semiconductor device as claimed in claim 12 wherein the dry etching process is a process of exposing the conductive plug from the second main surface of the semiconductor substrate in a state where the

conductive plug is covered with the application insulating film.

14. The method of manufacturing a semiconductor device as claimed in claim 13 further comprising:

a step of removing the application insulating film covering the conductive plug which is exposed from the second main surface by a chemical mechanical polishing method; and

a step of forming a contact pad on the conductive plug from which the application insulating film is removed.

15. The method of manufacturing a semiconductor device as claimed in claim 13 further comprising:

a step of removing the application insulating film covering the conductive plug which is exposed from the second main surface by an ashing process; and

a step of forming a contact pad on the conductive plug from which the application insulating film is removed.